Claims

1. A method for the detection of the reception of a data frame in an input signal (y_{OFF} (n)), said data frame comprising periodically repeated symbols at the beginning, comprising the steps of

   a) sampling said input signal (y_{OFF} (n)) with a predetermined sampling rate,

   b) generating a first signal ($|J(k)|^2$) that is dependent on an autocorrelation of said input signal with a delayed copy of said input signal, and

   c) detecting a plateau in said first signal ($|J(k)|^2$)

   d) generating an output signal that is indicative of detecting said plateau.

   wherein said step of detecting a plateau comprises the steps of

   c1) generating a differentiator signal (J_{diff} (k)), which is dependent on the difference of a first sample of said first signal and a second sample of said first signal that was taken a first predetermined number of sampling periods earlier, and

   c2) detecting an absolute maximum of said differentiator signal (J_{diff} (k)) within a second predetermined number of sampling periods.

2. The method according to claim 1, wherein said step c2) of detecting an absolute maximum comprises an instantaneous peak detection step and a step of detecting a falling slope in the differentiator signal (J_{diff} (k)).

3. The method according to claim 2, wherein the instantaneous peak detection step and the group peak detection step are performed in parallel.

4. The method of claim 2 or 3, wherein the instantaneous peak detection step comprises a step of comparing the differentiator signal (J_{diff} (k)) of a current sampling period with the differentiator signal (J_{diff} (k)) of a next previous sampling period, and a step of saving the differentiator signal (J_{diff} (k)) of the current sampling period to a register, given the condition that its value is larger than that of the differentiator signal (J_{diff} (k)) of the previous sampling period.

5. A method according to claim 4, comprising a step of incrementing a count index by one, given the condition that the value of said differentiator signal (J_{diff} (k)) of said current sampling period is equal or smaller than that of said differentiator signal (J_{diff} (k)) saved in said register.

6. A method according to claim 5, comprising a step of generating an instantaneous peak detection signal indicative of the condition whether or not the count index has reached a predetermined count value.

7. A method according to claim 1, comprising a step of detecting a falling slope in said differentiator signal (J_{diff} (k)).

8. A method according to claim 7, wherein detecting a falling slope comprises the steps of

- generating an accumulation signal that is dependent on the sum of said differentiator signal (J_{diff} (k)) over a fourth predetermined number of consecutive sampling periods
- comparing said current accumulation signal with the last previous accumulation signal representing without overlap said fourth predetermined number of consecutive earlier sampling periods
- generating a group peak detection signal indicative of whether or not the value of said current accumulation signal is smaller than the value of said earlier accumulation signal.

9. A method according to claims 6 and 8, comprising a step of generating a maximum detection signal indicative of the condition

- that said instantaneous peak detection signal indicates that the count index has reached the predetermined count value and

- that said group peak detection signal indicates that the value of said current accumulation signal is smaller than said value of said earlier accumulation signal.

10. A method according to any one of the preceding claims, wherein said output signal is indicative of the time of detecting said plateau.

11. A method according to any one of the preceding claims, wherein said method is used for detecting a data frame containing OFDM symbols.

12. A method according to any one of the preceding claims, wherein the input signal is amplified such that the power of the amplified input signal is in a predetermined power range.

13. A method according to claim 1 or 12, wherein the step of detecting a plateau in said first signal ($|J(k)|^2$) is performed only if the first signal exceeds a predetermined threshold value.

14. A frame detector for detecting the reception of a data frame in an input signal ($y_{OFF}(n)$), said data frame comprising periodically repeated symbols at the beginning, comprising

a) a sampling unit adapted to sample said input signal ($y_{OFF}(n)$) with a predetermined sampling rate

b) an autocorrelation unit adapted to transform said input signal ($y_{OFF}(n)$) into a first signal ($|J(k)|^2$) that is dependent on an autocorrelation of said input signal with a delayed copy of said input signal, and

c) a plateau detector, adapted to detect a plateau in said first signal ($|J(k)|^2$)

d) an output unit adapted to generate an output signal that is indicative of detecting said plateau,

wherein said plateau detector is adapted to generate a differentiator signal ($J_{diff}(k)$), which is dependent on the difference of a first sample of said first signal and a second sample of said first signal a predetermined number of sampling periods earlier, to detect an absolute maximum of said differentiator signal ($J_{diff}(k)$) within a predetermined range of sampling periods, and to provide a signal indicative of detecting said absolute maximum to said output unit.

15. The frame detector of claim 14, wherein said plateau detector comprises a peak detection unit with

a) a first detection unit connected to said input port and comprising a first memory unit, said first detection unit being adapted to

- comparing said input signal ($J_{diff}(k)$) received through said input port with a first entry contained in said first memory unit, and to

- replacing said first entry by said input signal given the condition that the value of said input signal ($J_{diff}(k)$) is larger than the value of said first entry,

b) a second detection unit connected to said input port and comprising a second memory unit, said second detection unit being adapted to

- generating an accumulation signal, that is dependent on the sum of a current input signal ($J_{diff}(k)$) and of said fourth predetermined number of previous input signals ($J_{diff}(k)$),

- comparing said accumulation signal with a second entry contained in said second memory for at least , and to
- replacing said second entry by said accumulation signal given the condition that the value of said accumulation signal ($J_{diff}(k)$) is larger than the value of said second entry,

said peak detection unit being adapted to providing a peak detector output signal at its output port indicative of whether or not said first entry has been unchanged for a predetermined number of sample periods and said second entry has been changed in said current sampling period.

16. A synchronizing method comprising a step of detecting a frame in an input signal, wherein the frame detection step is performed with the method of at least one of the claims 1 to 11.

17. A synchronizing method according to claim 16, further comprising a step of estimating a relative frequency offset (f_ε) in an input signal ($y_{OFF}(n)$) after said step of detecting a frame, wherein the estimating step comprises the steps of

    a) estimating a coarse frequency offset (β)

    b) estimating a fine frequency offset (α) in dependence of said estimated coarse frequency offset (β).

18. The synchronizing method of claim 17, wherein the steps of estimating a coarse frequency offset (β) or of estimating a fine frequency offset, or both steps, comprise a step of calculating a phase value of said first signal ($|J(k)|^2$).

19. The synchronizing method of claim 17 or 18, wherein the step of estimating the frequency offset comprises a step of assigning a fine frequency offset value dependent on the value of the coarse frequency offset according to the following function:

$$\varepsilon=\alpha \quad ; \text{if } (-0.25)/4 \leq \beta \leq (0.25)/4 \quad \text{(R1)}$$

$$\varepsilon=\alpha \quad ; \text{if } \alpha \geq 0 \text{ and } (0.25)/4 < \beta < (0.75)/4 \quad \text{(R2)}$$

$$\varepsilon=1+\alpha \quad ; \text{if } \alpha < 0 \text{ and } (0.25)/4 < \beta < (0.75)/4 \quad \text{(R3)}$$

$$\varepsilon=1+\alpha \quad ; \text{if } \beta \geq (0.75)/4 \quad \text{(R4)}$$

$$\varepsilon=-1+\alpha \quad ; \text{if } \alpha \geq 0 \text{ and } (-0.75)/4 < \beta < (-0.25)/4 \quad \text{(R5)}$$

$$\varepsilon=\alpha \quad ; \text{if } \alpha < 0 \text{ and } (-0.75)/4 < \beta < (-0.25)/4 \quad \text{(R6)}$$

$$\varepsilon=-1+\alpha \quad ; \text{if } \beta \leq (-0.75)/4 \quad \text{(R7)}$$

20. The synchronizing method of claim 17 or 18, wherein the step of estimating the frequency offset comprises a step of assigning a fine frequency offset value dependent on the value of the coarse frequency offset according to the following function:

$$\varepsilon=\alpha \quad ; \text{if } (-0.1)/4 \leq \beta \leq (0.1)/4 \quad \text{(R1)}$$

$$\varepsilon=\alpha \quad ; \text{if } \alpha \geq 0 \text{ and } (0.1)/4 < \beta < (0.9)/4 \quad \text{(R2)}$$

$$\varepsilon=1+\alpha \quad ; \text{if } \alpha < 0 \text{ and } (0.1)/4 < \beta < (0.9)/4 \quad \text{(R3)}$$

$$\varepsilon=1+\alpha \quad ; \text{if } \beta \geq (0.9)/4 \quad \text{(R4)}$$

$$\varepsilon=\alpha \quad ; \text{if } \alpha < 0 \text{ and } (-0.9)/4 < \beta < (-0.1)/4 \quad \text{(R5)}$$

$$\varepsilon=-1+\alpha \quad ; \text{if } \alpha \geq 0 \text{ and } (-0.9)/4 < \beta < (-0.1)/4 \quad \text{(R6)}$$

$$\varepsilon = -1 + \alpha \quad ; \text{if } \beta \leq (-0.9)/4 \qquad \text{(R7)}$$

21. The synchronizing method of one of the claims 16 to 20, further comprising a step of correcting the input signal by the estimated value.

22. The synchronizing method of claim 21, further comprising after said step of frequency offset correction a step of estimating the time of reception of at least one symbol contained in a received data frame (hereinafter symbol timing step).

23. The synchronizing method of claim 22, wherein the symbol timing step comprises a step of generating a crosscorrelation signal, which is dependent on the value of the crosscorrelation of the corrected input signal with a known reference signal, wherein the reference signal is a first section of long preamble symbols included in the data frame.

24. The synchronizing method of claim 23, wherein the reference signal is 32 samples long.

25. The synchronizing method of one of the claims 22 to 24, further comprising a step of estimating a reference channel.

26. The synchronizing method of claim 25, wherein estimating the reference channel comprises a step of performing a Fast Fourier Transform of a second section of the long preamble symbols included in the data frame.

27. A synchronizer device comprising a frame detector according to claim 14 or 15.

28. The synchronizer device of claim 27, further comprising a symbol timing unit adapted to generate a crosscorrelation signal, which is dependent on the value of the crosscorrelation of the corrected input signal with a known reference signal, wherein the reference signal is a first section of long preamble symbols included in the data frame.

29. The synchronizer device of claim 28, wherein the symbol timing unit comprises a crosscorrelation unit with a number of multipliers for complex numbers, and wherein at least one multiplier is made of a combination of XNOR-gates, inverter gates and adders.

30. The synchronizer device of one of the claims 27 to 29, wherein the frame detection unit and the symbol timing unit can be enabled or disabled individually.